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Wind Turbines and Health: The Noise Connection, with Aslak Harbo Poulsen

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For some people, the whoosh of wind turbines is the sound of clean energy. For others, it is the sound of an environmental exposure that could possibly cause adverse health effects. Wind turbine noise has been studied in relation to diabetes, hypertension, preterm birth, and more. In this podcast, Aslak Harbo Poulsen discusses his research on wind turbine noise in relation to two more outcomes: likelihood of filling prescriptions for sleeping pills or antidepressants, and risk of heart attack or stroke. https://doi.org/10.1289/EHP5568

NARRATOR [00:00:00]: *EHP* presents "The Researcher's Perspective."

[Theme music]

AHEARN [00:00:09]: It is "The Researcher's Perspective." I am Ashley Ahearn.

Take a listen to this.

[Wind turbine noise[1]]

For some, that wind turbine you are hearing is the sound of clean energy. For others, it is an annoyance that contributes to sleep loss and even the need for medication.

Global cumulative wind capacity has skyrocketed in recent years. And in Denmark, wind power provides more than 40% of energy consumption[2]—the largest percentage of any country in the world.

So, it is perhaps not surprising that Danish scientists wanted to better understand how wind turbine noise might affect human health. Two papers recently published in *Environmental Health Perspectives* begin to explore just that.

One paper looks at how living near wind turbines might be associated with higher use of antidepressants and sleep medications.[3] The other asks if there is a connection between living near wind turbines and incidence of heart attack or stroke.[4]

Joining me to talk about the research is lead author of both studies, Aslak Harbo Poulsen. He's an epidemiologist with the Danish Cancer Society Research Center.

Dr. Poulsen, welcome to "The Researcher's Perspective."

POULSEN [00:01:17]: Thank you.

AHEARN [00:01:19]: I want to get into your recent publications here in a minute, but first, let's start a bit more broadly. What do we know about how living near a wind turbine might affect your health?

POULSEN [00:01:26]: We know that people living near wind turbines report to be annoyed, and oftentime, at the same noise level they find the wind turbine noise to be more annoying than what you would expect from air traffic or road traffic. And there have been done some studies on health effects but they have all had limitations; basically, [those]: studies had a weak design. People are concerned, and that was the starting point for our study. They feel they have health effects, but we can not say for sure whether they do.

AHEARN [00:01:54]: And I've heard also that beyond annoyance there are issues with the shadow flicker and the kind of change of light patterns that can be associated with a wind turbine nearby?

POULSEN [00:02:02]: Yeah, I mean that's also potentially sources of annoyance just as the potential concern about your, your real estate value is also a cause of annoyance.

AHEARN [00:02:12]: Yeah. Let's talk more about the idea of annoyance here. When I think of the word, you know, layman's terms, to be annoyed by something does not necessarily mean my health will be affected. It just means I am vaguely upset usually, right?

POULSEN [00:02:24]: Yeah. I mean in our understanding, it is one step further. Basically, you are at the point where you are thinking, "There's a lion about to eat me, I need to respond to that." My body will prepare to respond to that.

AHEARN [00:02:34]: I see, it is a stress response you are talking about.

POULSEN [00:02:36]: It basically is. It is when the annoyance reaches the levels where it can elicit a stress response [that]: it becomes really relevant from a health perspective.

AHEARN [00:02:45]: And we know that chronic stress, or low-level, long-term stress, does indeed have health implications.

POULSEN [00:02:50]: Exactly. Long-term stress and long-term sleep disturbances do have health effects.

AHEARN [00:02:56]: Now, you had access to a pretty phenomenal data set in conducting your research. So let's start with your paper on proximity to wind turbines and how it correlates with the use of sleep medication and antidepressants. Tell me a little bit about how you gathered your data and analyzed it.

POULSEN [00:03:09]: Yeah, the first thing to maybe say is that the study was conducted in Denmark. And Denmark is a thoroughly registered country: Everybody has a personal identification number that is used in all contacts with administrative bodies and health care and everything. So we can track people, and we are allowed to track people, across their medical histories and their address histories and everything. We follow each and every Dane on register.

So the first step we did was we identified all wind turbine locations and the type of wind turbine at these locations in Denmark since 1982. And then we made a rough division of all dwellings in Denmark depending on could they under worst circumstances hear a wind turbine, yes or no? And the dwellings that could under no circumstances ever hear wind turbine, we just said they, we will not spend more time on those, and they are left as unexposed dwellings.

For the rest, we then modeled, hour by hour, wind speed and temperature and wind direction at each and every wind turbine in Denmark. And for these wind turbines, we also found information about the noise spectrum describing frequency-specific noise levels at different wind speeds. So that was the initial data set—we had hour-by-hour wind turbine noise models for all dwellings in Denmark. And the dwellings where we did actually the modeling was slightly more than half a million dwellings.

AHEARN [00:04:27]: And then you correlated those noise levels with health outcomes, right? Tell me what were you looking at there?

POULSEN [00:04:32]: Yeah, we looked at whether long-term exposure influenced the likelihood of you getting a prescription or at redeeming prescriptions for sleep medication or antidepressant medication.

AHEARN [00:04:42]: And what did you find?

POULSEN [00:04:43]: Well, we found actually that in our data, there was a significantly increased risk of redeeming

prescriptions for sleep medication among those with the highest exposure levels. And we saw similar results for the antidepressants, but not reaching significance, which can be because it is not a true effect, or it can be by chance. But basically, the two medications looked similar; sleep disturbance and depressions are very correlated outcomes.

AHEARN [00:05:09]: And you also found discrepancies in age groups, correct?

POULSEN [00:05:11]: Yeah, exactly. So, what we found in our data set was that it appears that in the elderly population there was an association between wind turbine noise and redeeming these medications.

AHEARN [00:05:22]: But it is not necessarily uncommon for elderly people to have trouble sleeping or generally be lighter sleepers. I wonder, how did you control for that in your analysis?

POULSEN [00:05:30]: I mean, it is definitely not uncommon. I mean, in the ideal world where wind turbines had no effect, we wouldn't expect that to be different by distance to wind turbines, and we're comparing people of the same age at the different noise levels. So, a person living with a high wind turbine noise being aged 75 is compared to a person living further away who is also aged 75.

Another aspect of this—that old people may sleep more lightly and use this medication more—is, could also explain why we only see the results in the elderly. So it could possibly be that those, that the younger people are also disturbed, but just not to an extent where they actually get the prescriptions.

AHEARN [00:06:10]: Okay, I want to shift gears now. Let's talk about your research on wind turbines and heart health. You looked at incidence of stroke and heart attack in relation to proximity to wind turbines. Tell me about those findings. Is there a connection there?

POULSEN [00:06:21]: I mean, of course there's a connection, but the results are in no way similar. When we looked at the long-term exposure, we did not see any association with wind turbine noise exposure, either indoors or outdoors, and the risk of getting stroke or myocardial infarction. We did, however, also look at short-term exposure. I mean basically, if you have high exposure to wind turbine noise today, can it influence the risk of you getting a stroke or myocardial infarction tomorrow? So not can it cause the disease, but can it trigger, can it be the last step that pushes you over the edge?

And there we did find some suggestion of an association that indoor noise could be associated, or could be a trigger for, these diseases. But that was based on, on very, very small numbers and could also just be chance. But it is also really something I hope somebody else will investigate further.

AHEARN [00:07:07]: So these two papers are part of a much larger study that your group is doing, has been doing, with funding from the Danish government. What other health effects have you studied, and tell me a little bit about your findings.

POULSEN [00:07:18]: We also looked at whether long-term exposure could cause diabetes, and we did not find any association.[5] We have found an association with road traffic noise,[6] I might mention, but we did not find any association with the wind turbine noise. And we looked at whether long-term exposure could influence the risk of you redeeming prescriptions for antihypertensive medication, without finding any clear association.[7] There were some suggestions in the elderly, but we concluded basically that was no association overall. And then we looked at whether exposure during pregnancy could influence the risk for preterm birth or low birth weight, and there we did not find any association.[8] However, there were very, very few women that were pregnant and living in houses with these high exposure levels.

AHEARN [00:08:01]: Denmark has made a name for itself as one of the leading champions and producers of wind turbines and turbine technology, and the Danish government is funding your research. I wanted to ask, have you felt any pressure to come to certain conclusions in your research?

POULSEN [00:08:16]: No, actually, not at all. When we signed the contract, we demanded that it should be so that of course they gave us the money and we should document that we were using them in a rightly fashion, but they could not see any results until the papers were accepted by the scientific journals. And there has been no pressure at all to get insight into our results.

AHEARN [00:08:37]: All right, I want to, I want to take a listen together here; let me just play you some sound.

[Wind turbine noise[1]]:

There's a good chance that we will be hearing more of this kind of sound in the future. Climate change presents many challenges for society, and the top of that list is the need to reduce our dependence on fossil fuels, and that means ramping up renewable energy production like wind power. As you look ahead to a future that may involve more wind turbines, more sounds like that, what are your hopes or concerns when it comes to human health?

POULSEN [00:09:07]: I mean, that, that becomes—first of all, we do not know whether the wind turbines actually affect your health; that needs to be established. But even once that is established, that should be weighed in against all the other impacts on your health. I mean, the alternative energy sources will also affect your health, and global change could also affect your health. So it becomes a very political question, who should bear what burdens?

As a scientist, I think decisions should be based on science, and in terms of health effects from wind turbines, we need more studies to get that knowledge from which to make sound decisions.

AHEARN [00:09:39]: Dr. Poulsen, what excites you about this research now as you look ahead to a future with climate change and with potentially more renewable energy like wind on the grid? What are you eager to explore as a scientist?

POULSEN [00:09:51]: That's a really difficult question.

AHEARN [00:09:52]: Really? You have devoted your career to this. What turns you on about this research?

POULSEN [00:09:59]: I mean, to me it was interesting to investigate something where we did not know up front whether there were any health effects. People, they are quite dismissive maybe by saying, "Well, the noise levels from wind turbines are so low, so why should we be concerned?" So it was quite interesting to move into this area and see, well, if we do it more scientifically, what can we actually find? Is there reason for concern? Or is there no reason for concern? I thought that was quite, quite exciting.

AHEARN [00:10:24]: Dr. Poulsen, thanks so much for joining me.

POULSEN [00:10:26]: You are welcome.

AHEARN [00:10:27]: Dr. Aslak Harbo Poulsen is an epidemiologist with the Danish Cancer Society Research Center. His research on wind turbine noise and how it may affect human health was published in the March 2019 issue of *EHP*.

[Theme music]

I am Ashley Ahearn. Thanks for listening to "The Researcher's Perspective."

The views and opinions expressed in this podcast are solely those of our guest and do not necessarily reflect the views, opinions, or policies of Environmental Health Perspectives *or the National Institute of Environmental Health Sciences.*

References and Notes

1. Kristianpont. 2012. Wind Turbine Sound—High Quality Video. [Video.]: https://www.youtube.com/watch?v=Mk5zMxYVca0 [accessed 2 May 2019]:.
2. State of Green. 2019. 2018 Was a Great Year for Danish Wind Energy. Copenhagen:State of Green. https://stateofgreen.com/en/partners/state-of-green/news/2018-was-a-great-year-for-danish-wind-energy/ [accessed 2 May 2019]:.
3. Poulsen AH, Raaschou-Nielsen O, Peña A, Hahmann AN, Nordsborg RB, Ketzel M et al. 2019. Impact of long-term exposure to wind turbine noise on redemption of sleep medication and antidepressants: a nationwide cohort study. Environ Health Perspect 127(3):37005, PMID: 30864815, https://doi.org/10.1289/EHP3909.
4. Poulsen AH, Raaschou-Nielsen O, Peña A, Hahmann AN, Nordsborg RB, Ketzel M et al. 2019. Long-term exposure to wind turbine noise and risk for myocardial infarction and stroke: a nationwide cohort study. Environ Health Perspect 127(3):37004, PMID: 30864814, https://doi.org/10.1289/EHP3340.
5. Poulsen AH, Raaschou-Nielsen O, Peña A, Hahmann AN, Nordsborg RB, Ketzel M et al. 2018. Long-term exposure to wind turbine noise at night and risk for diabetes: a nationwide cohort study. Environ Res 165:40–45, PMID: 29665463, https://doi.org/10.1016/j.envres.2018.03.040.
6. Sørensen M, Andersen ZJ, Nordsborg RB, Becker T, Tjønneland A, Overvad K et al. 2013. Long-term exposure to road traffic noise and incident diabetes: a cohort study. Environ Health Perspect 121(2):217–222, PMID: 23229017, https://doi.org/10.1289/ehp.1205503.
7. Poulsen AH, Raaschou-Nielsen O, Peña A, Hahmann AN, Nordsborg RB, Ketzel M et al. 2018. Long-term exposure to wind turbine noise and redemption of antihypertensive medication: a nationwide cohort study. Environ Int 121(Pt 1):207–215, PMID: 30216773, https://doi.org/10.1016/j.envint.2018.08.054.
8. Poulsen AH, Raaschou-Nielsen O, Peña A, Hahmann AN, Nordsborg RB, Ketzel M et al. 2018. Pregnancy exposure to wind turbine noise and adverse birth outcomes: a nationwide cohort study. Environ Res 167:770–775, PMID: 30236517, https://doi.org/10.1016/j.envres.2018.09.011.